Book Reviews

On Human Communication. A review, a survey, and a criticism. Colin Cherry. Technology Press, Cambridge, Mass.; Wiley, New York, 1957. 333 pp. Illus. $6.75.

Civilization, as we know it today, would have been impossible without the evolution of phonetic speech and written language. By means of symbols, man has learned how to transmit and to preserve his ideas and inventions. In this way he has also pierced the barriers of time and space.

Recent advances in communication engineering have created a demand for a critical inventory of our fragmentary knowledge of the field of human communication. The initiative was taken by Massachusetts Institute of Technology, and the task was assigned to an expert who is well known in this country and abroad for his breadth of interest, especially for his mathematical studies. Colin Cherry is the Henry Mark Pease reader in telecommunication at the University of London.

This book, the first of a projected series, is a lucid summary pitched to the needs of "newcomers" in communication theory and calculated to reveal the inherent unity between the diverse facets of the subject: linguistics, sociology, neurophysiology, semantics, philosophy, engineering, psychology, and so on.

Following a definition of current terms, Cherry gives a concise, historical review of the rise of "communication science" (specifically, languages and codes, a review of mathematical theory and scientific method, and a discussion of "Brains—real and artificial." It was heartening to me (a social psychologist) to note the author's clarity on this point. The layman has been grossly misled recently by much journalistic humbug eulogizing "electronic brains." Says Cherry: "The inaccessibility and complexity of the central nervous system and of the brain render direct analysis overwhelmingly difficult; the brain may contain more than 10^{10} nerve cells, whereas the most complicated computing machine has only some 10,000 relay units. . . ." (page 60).

Equally refreshing is the treatment of "Signs, language, and communication," in which Cherry appears to be as familiar with the work of such theorists as Carnap (semantics, symbolic logic) and Sapir (linguistics) as with the authorities in his own specialty—the physical analysis of signals, including speech.

The hard core of the book deals with statistical communication theory and the related body of empirical knowledge which, since it rests upon "a solid foundation of mathematics," eludes popularization. The treatment of the relevant topics is limited and is intended chiefly as a guide to the literature of the subject.

Under "Logic of communication," the author presents a miscellany of useful, albeit unrelated, topics. His allusions to John Locke's theory of signs, "semiotic," with its three levels—syntactics, semantics, and pragmatics—and to the little-known work of Charles Peirce and his pragmatic philosophy of signs are very illuminating.

Finally, Cherry reenters the psychological field and deals cursorily with the topics cognition and recognition and with the search for invariants. He concludes his survey with the sound deduction that man is distinguished from the animals by reason of (i) the scope and organization of his concepts and (ii) his capacity to communicate with the aid of language.

This volume fills a long-felt need for a synthesis of the theoretical and empirical knowledge of the field. The bibliography of 367 titles is indicative of the book's broad scope. The design of the study is admirable, and the execution is superb. Moreover, the book itself is, indeed, a model of human communication.

ARTHUR L. BEELEY
University of Utah

Galactic Nebulae and Interstellar Matter. Jean Dufay. Translated by A. J. Pomerans. Philosophical Library, New York, 1957. 352 pp. $15.

In 1926, A. S. Eddington of Cambridge University presented before the Royal Society of London an epoch-making Bakerian lecture in which he revived the old and almost forgotten hypothesis of J. Hartmann that interstellar space is filled with clouds of calcium atoms and placed it on a solid foundation of theoretical reasoning. Four years later, R. J. Trümpler at Lick Observatory and C. Schalén in Uppsala established the existence in interstellar space of vast clouds of small, scattering, solid particles which weaken the light of distant stars and cause it to appear redder than would be the case if space were transparent. Since then, an enormous amount of work has been done on the properties of the interstellar medium. Th. Dunham and I established, both theoretically and by means of observations, that hydrogen is the most abundant element in interstellar space and that many large areas of the Milky Way emit a faint glow in the red line of hydrogen alpha. B. Strömgren developed his famous theory of ionized (H II) and un-ionized (H I) regions in the galaxy and deduced their average densities and temperatures. W. A. Hiltner and J. S. Hall discovered the polarization of the transmitted light of distant stars, while J. L. Greenstein and L. Davis explained this effect theoretically as a consequence of a preferential orientation of the crystallike interstellar particles by a large-scale magnetic field, of the order of 10^{-5} gauss. E. Fermi and S. Chandrasekhar had assumed the existence of such a field in order to explain some of the properties of cosmic rays. L. Spitzer, Jr., at Princeton, and his pupils, investigated the cosmogonical effects of the diffuse interstellar medium, while J. H. Oort and H. C. van de Hulst in Leiden pioneered in the field of radio-observations, especially of the 21-cm line of hydrogen, which has given new and wholly unexpected results in several fields of astrophysical research.

Galactic Nebulae and Interstellar Matter is a translation from the original French edition of 1954, with certain minor revisions that bring the text up to date (to 1955). The author states that the book is intended both for the professional astronomer and for the layman interested in astronomy. He has certainly succeeded magnificently with regard to his second objective: the style is easy, and the reader (who must have some modest amount of knowledge of physics) is taken step by step from one intriguing problem to another. But the professional astronomer may find the book somewhat lacking in the most recent developments, such as the discovery of "synchrotron radiation" in the Crab nebula, the origin of cosmic rays, the interaction between stars and nebulae, and so forth.

The translator has, on the whole, succeeded in retaining the delightful style of the French original. But, unfortunately, he has used many strange and often misleading expressions by translating too literally the original French words: the term *Schmidt chamber* (page 112) sounds strange in English, and there are many more instances of the same

kind. A serious reader will also be disappointed at the amazing number of misspelled names: "Pearse" instead of "Pearce," "Osterbrok" instead of "Osterbrock," "Matsukov" instead of "Maksutov," and so on.

The book consists of an introduction ("Some fundamental ideas of astrophysics") and of 19 chapters, arranged in four parts: (i) "Atoms and molecules in space," (ii) "Solid particles in space," (iii) "From atoms to grains and from grains to stars," and (iv) "Diffuse matter outside the Milky Way."

In conclusion, it is appropriate to mention that Dufay's own research has had a considerable influence on the development of the ideas discussed in his book. Thirty years ago he investigated the relative contributions to the diffuse light of the night sky of the "air-glow," of resolved and unresolved stars, of starlight scattered by interstellar particles, and so on. His most recent work with infrared-sensitive photographic emulsions and suitable light filters has demonstrated the relatively much greater transparency of space in infrared light than in ordinary blue or violet light.

OTTO STRUVE
University of California, Berkeley

Analytical Microscopy. Its aims and methods in relation to foods, water, spices, and drugs. T. E. Wallis. Little, Brown, Boston, Mass., ed. 2, 1957. 215 pp. Illus. $5.50.

For many years, fortunate was the microscopist who had access to T. E. Wallis' little book. Now we can all have a copy that is twice as large and has twice the number of illustrations, plus two appendixes—one of numerical data on seed weights, vein-islet numbers, leaf palisade ratios, stomatal numbers, pollens, and drug powders and the other on formulas for useful stains and reagents. The bibliography is modernized, and the author is now listed as a member of the Society for Analytical Chemistry rather than of the Society of Public Analysts.

The materials examined are foods, drugs, fibers, mineral substances, and water. Measurement, drawing, and quantitative methods are described and discussed by an old master. Clear drawings are given to aid in identification of starches, plant fragments, insects, and other contaminants associated with these products. There are many numerical data on the sizes of botanical materials.

The outstanding advantage of this book, in my opinion, is the description and discussion of the basic methods of preparing a sample and of procedures for examination with the microscope. The book is practical, is largely based on the author's broad experience as a microscopist, and considers problems that are not solvable by chemical methods alone. The professional microscopist will gain more from the book than will those working in a limited field, although any student who has to use a microscope will benefit from browsing among these chapters. By some, methods which do not include ultrathin sectioning, and so on, will be considered old-fashioned; others will agree with Wallis that shrinkage and distortion should be avoided whenever possible.

OSCAR W. RICHARDS
American Optical Company

A Monograph of the Immature Stages of African Timber Beetles (Cerambycidae). E. A. J. Duffy. British Museum (Natural History), London, 1957. 338 pp. + plates. £5 5s.

This is the second in a proposed series of monographs on larvae of timber beetles. It corresponds in format and presentation to the previous volume. Species from Madagascar and other neighboring islands are included, in addition to those from Africa. Readily workable keys are presented, which make possible for the first time the identification of "all species of major importance."

Significant morphological characters are adequately described and often clearly illustrated, and there are ten plates of excellent black-and-white photographs showing typical damage. Information on biology, hosts, and distribution and often on parasites or predators is made available, much of it for the first time. A remarkably complete bibliography of significant papers is presented.

W. H. ANDERSON
U.S. Department of Agriculture

The Granite Controversy. Geological addresses illustrating the evolution of a disputant. H. H. Read. Interscience, New York, 1957. xix + 430 pp. Illus. $6.75.

The Granite Controversy brings together eight addresses by H. H. Read, delivered between 1939 and 1954, all on the controversial topic of the origin of granite. Some of the earlier of these addresses were not widely distributed because of war conditions; in any event, this republication in a single volume is very useful. Anyone who has had the privilege of hearing Read speak does not have to be told of the vigor of his prose or of his humor and his skill in debate. The book is well written, with life and verve, and, even though from the nature of the material there is considerable repetition, it is a pleasure to read.

No one could consider the book an objective weighing of the evidence—in fact, the author freely admits his bias toward granitization rather than toward a magmatic origin for granite. To him, all granite masses are members of a "granite series," to be traced from one geologic environment to another, through time. Their associated rocks and structural relations vary widely but can be considered to form a consistent pattern. In regionally metamorphosed terrains, many bodies are derived from essentially undisplaced sedimentary or volcanic rocks. Emanations from the mantle have introduced silica, potassa, alumina, and other substances to produce a metamorphic aureole, passing inward from schist, through gneiss, to migmatite, and finally to granite. The material of the granite mass was hot enough and had enough interstitial fluids to flow readily, yet it was never molten. Owing to its plasticity and low density, orogenic stresses cause some of the material to rise, so that it ultimately comes, in part, to occupy spaces far distant from, and at shallower levels than, the site of the transformation of the parental rocks. These cross-cutting granites have contact aureoles of the Barr-Andlau type that have led to the idea that granites have been derived from molten rock or magma. Although they are traveled bodies, their origin, like that of the granites of metamorphic terranes, lay in the transformation of older rocks. Parts of these cross-cutting bodies may have been molten, but the bulk was probably crystalline throughout time, so that the emplacement was of a crystal mush.

Read's disarming preface emphasizes the undoubted fact that the origin of granite clearly took place under conditions not susceptible of laboratory duplication and states that therefore field evidence should control our theory of origin. The interpretation put on identical field relations by different geologists will necessarily vary with their individual experiences. Geologists working in nonmetamorphic terranes have naturally differed in their inferences from those working in regionally metamorphosed rocks. The idea of magmatic granite has arisen in nonmetamorphic regions. Clearly, Read's experience has been chiefly among the regionally metamorphosed rocks.

Read's conclusion that granites have not arisen, in general, by crystal fractionation of a basaltic magma—the theory to which Bowen's name is inseparably attached—will probably be accepted by most field geologists. There simply are not the vast quantities of intermediate intrusive rocks that this theory demands. Read's insistence on a distinctly